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Curecanti National Recreation Area **Elk Creek Area Wells and Water Supply**

General Description

Water for facilities at Elk Creek was initially supplied by pumping surface water from the reservoir, treating it, and sending it to a storage reservoir on the hill south of the headquarters area. In Spring 1971, there were problems with partial collapse of the intake pipe in the reservoir. A deep well was constructed near the water treatment building in 1973 as a replacement for the surface-water source. There is no clear record of whether, or how long, the well was used. Notes in WRD files indicate it was abandoned because the water quality was poor and the casing had bent or sheared, the pump no longer worked, and it could not be removed. This deep (550 foot) well was later permitted as an injection well for effluent from the surface water treatment plant.

In 1987, two 400-foot wells were constructed in the campground. The wells were drilled almost entirely within bedrock of the Black Canyon Schist Formation underlying the area. Groundwater was obtained from fractures in the schist. These wells initially produced good amounts of water. Yield declined within a few months and the park was again treating surface water from the reservoir. Notes in WRD files indicate that two more holes were drilled in the campground, but they were dry.

During a low water year (1998), the park was able to construct a pipeline across the then dry East Elk Creek Bay and make a connection with the Well No. 3 at the “Bay of Chickens”. This is currently (2012) the primary water supply for facilities at Elk Creek.

In Fall 2011, a project was conducted to attempt repair/rehab of Well No. 2 in the campground and to construct a test well at a location north of the campground where the hydrogeology was expected to be more favorable for obtaining groundwater. The repair/rehab of Well No. 2 was unsuccessful because the PVC liner could not be removed. However, a new 9 gpm pump was installed to provide an alternative water source.

A new well (Well No. 4) was constructed north of the campground in Fall 2011. The new well was completed in the Junction Creek Sandstone; the same aquifer that supplies groundwater to Well No. 3. Well No. 4 should be able to meet the entire demand of NPS facilities in the Elk Creek area.

The combination of Well No. 3 and Well No. 4 provide the NPS Elk Creek area with a primary and secondary source of water, either of which can meet the entire demand of the water system.

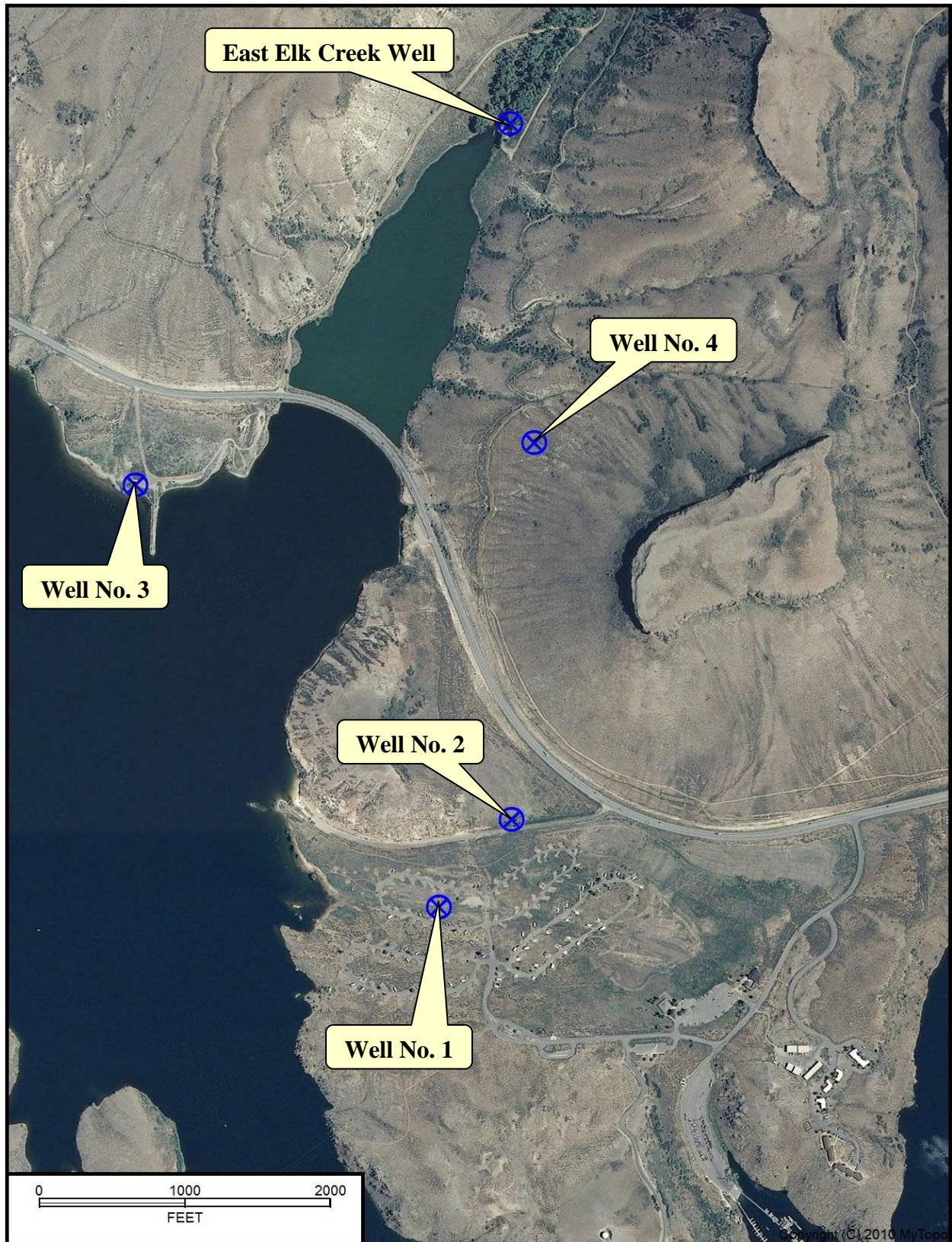


Figure 1. Map showing locations in the Elk Creek area.

Original Elk Creek Well

A deep well (550 feet) was constructed near the old water treatment plant in June 1973. It is located about 1400 feet south of the visitor center on the hill overlooking the narrows at an elevation of 7640 feet. The well was drilled through schist from 2-550 feet. The well reportedly produced 40-50 gpm. The well is no longer used because it reportedly produced poor quality water. Also, the casing is bent and the pump cannot be removed. The well was later permitted for injection of backwash from the lake water filtration system. The lake water filtration system was removed several years ago.

Elk Creek Well No. 1

Elk Creek Well No. 1 was constructed in June 1987. It is 400 feet deep, passing through topsoil, sandstone, and decomposed granite from 0-20 feet. From 20-400 feet the well was drilled through black granite, obtaining groundwater from various fracture zones. The “black granite” reported on the well completion report is really schist of the Black Canyon Schist Formation, erroneously called granite. The well was completed with 10-inch steel casing from 0-40 feet and 8-inch steel casing from 40-20 feet. Apparently the remainder of the well is an open borehole as there is no mention of a PVC liner and there was no billing for additional steel or PVC casing or well screen. The well was tested at various pumping rates. A 24-hour test upon completion of construction (June 6, 1987) produced a sustained yield of 20 gpm for 24 hours, resulting in drawdown from 21 feet to 218 feet. Other tests conducted by Westwater Associates (June 1987) and Twin Peaks Drilling (December 1987) verify that 20 gpm is about the maximum sustained yield for this well. The Colorado Division of Water Resources well permit number is 36109-F

A report by John Criger, DSC civil engineer, in 1990 stated that Well No. 1, “operated for approximately one year, started pumping large amounts of sand, and well capacity went from 15 gpm to 7 gpm.” There was speculation that the well had been completed in a perched aquifer. Two other wells constructed nearby were both abandoned because they were “dry”.

Currently (2012), the well is not used and has not been used since Well No. 3 was brought into service in 1998.

Elk Creek Well No. 2

Elk Creek Well No. 2 was constructed in November 1987. It is 400 feet deep and passed through sandstone, clay, and gravel from 0-80 feet and then granite from 80-400 feet. (Once again, the Black Canyon Schist is misidentified as granite.) The borehole diameter was 10-inch to 60 feet, 8-inch from 60-340 feet, and 6-inch from 340-400 feet. The well was completed with 8-inch steel casing from 0-60 feet and 6-inch PVC casing from 60-340 feet. Perforated PVC casing was used in the intervals from 80-100 feet, 140-160 feet, 200-220 feet, and 280-300 feet. The well is an open borehole from 340-400 feet. The well was tested on November 19-20, 1987 and produced an average of 33 gpm for 24 hours resulting in drawdown of the water level in the well from 62 to 280 feet below ground surface.

The well was originally issued permit 32263-F from the Colorado Division of Water Resources. Paperwork errors resulted in expiration of the permit. It was later reinstated as permit 33692-F

A report by John Criger, DSC civil engineer, in 1990 stated that Well No. 2, “pumped 35 gpm for approximately 6 months and then production dropped to about 7 gpm.” There was speculation that the fractures in the schist supplying water to the well had become plugged or that the well had been completed in a perched aquifer. Neither hypothesis seems very plausible. However, two other wells constructed nearby were both abandoned because they were “dry”.

Currently (2012), the well is equipped with a 9 gpm pump (which was installed in Fall 2011). The well is used for as a backup source to Well No. 3.

Elk Creek Well No. 3

Well No. 3 is the primary water supply for the Elk Creek area (2012). A pipeline was constructed from the well to the Elk Creek area in 1998 when the water level in the reservoir was low enough to allow construction. The Colorado well permit number is 33693-F.

Well No. 3 was completed in August 1988. It was originally constructed to provide a water supply in the area for a planned concession development for windsurfing. The well is 200 feet deep and obtains water from the Junction Creek Sandstone Formation. The well was constructed by drilling an 8-inch hole from 0-105 feet and installing 6-inch steel casing from 1 foot above ground surface to 105 feet below ground surface. The cement grout surface seal was placed between 7-27 feet to prevent surface water from entering the well. A 6-inch hole was drilled from 105-200 feet and 4-inch PVC screen and casing were installed with the screened intervals from 105-125 feet and 160-180 feet. The well was test pumped at 37 gpm (the maximum pumping rate for the test pump) for 24 hours, resulting in drawing the water level down to 61 feet below ground surface. The static water level was 48 feet below ground surface. Total drawdown from pumping the well at 37 gpm for 24 hours was 13 feet.

East Elk Creek Well

A shallow well was constructed at the East Elk Creek group campground in Fall 1980. The well was drilled to a depth of 50 feet. It encountered alluvium from 0-26 feet and Morrison Formation from 26-50 feet. The only source of water was the alluvium. The Morrison Formation is essentially impermeable, being comprised of mudstone and siltstone. The well was completed with 6-inch steel casing from 0-26 feet with perforations from 16-26 feet. Static water level was 8 feet. The well reportedly produced 5 gpm. The Colorado well permit number is 119671.

Discussion of conditions in 2005

The deep well at the water storage tank and the two deep wells in the campground were completed in bedrock of the Black Canyon Schist Formation. Schist is generally impermeable except where fractures in the rock are interconnected with adjacent water sources. Yield from these wells decreased with time and water quality apparently decreased. The water quality changes might be attributed to pumping decreasing the water pressure in the schist and allowing infiltration of poorer quality water from overlying volcanic rocks.

It may be possible to conduct rehab work on the wells in the campground to restore their yield. Rehab work would include pulling the pumps and equipment from both wells and pulling the PVC liner from the No. 2 well. The wells could then be video-logged to look for problems, jetted to remove any encrustation or sediment buildup, and hydrofracked to possibly increase yield.

When the wells in the campground (Elk Creek No.1 and No. 2) were constructed in 1987, the arsenic concentrations were 11 ppb and less than 5 ppb respectively. Recent testing in 2002 and 2003 showed arsenic concentrations of 47 and 42 ppb respectively. If these wells will continue to be used as part of the public water supply for the area, then treatment will be necessary to lower the arsenic concentration. Additional testing should be conducted on water from these wells prior to the implementation of the new arsenic standard (10 ppb) in January 2006. This testing would entail pumping as much water from these wells as possible throughout the summer and conducting periodic testing of the arsenic concentration. This will allow determination of the arsenic concentration in the aquifer and aid in selecting a method for arsenic reduction if that is necessary.

Well No. 3 has been a reliable supply of good-quality water for several years. It is a vulnerable source to be dependent on because the pipeline from the well to the storage tank passes under the reservoir and would be difficult to repair if it broke at any time other than when the reservoir level was very low. Well No. 3 was completed in, and draws water from, the Junction Creek Sandstone Formation, a sandstone unit overlying the granite. Because of the dip of the geologic formations in the Elk Creek area, the sandstone is exposed at land surface near headquarters and the maintenance area, but is dry in those areas due to its occurrence at an elevation higher than the reservoir. The sandstone occurs at progressively lower elevations toward the north-northwest and is saturated with water recharging it from the reservoir in the vicinity of the well.

If an additional well is needed in the future, the target aquifer could be the Junction Creek Sandstone in the area north-northwest of the campground. It may be possible to intercept a sufficient thickness of sandstone in the area south of Highway 50 on the east side of the East Elk Creek embayment. Otherwise it will probably be necessary to construct the well further west (approx ¼ mile) from the current location of Well No. 3 so as to not create overlapping of drawdown cones for the two wells.

2011 Repair/Rehab of East Elk Creek Well No. 2

The intent of the repair/rehab project at Well No. 2 was to restore the production capability of the well. The old pump was removed. Several attempts to remove the PVC liner were unsuccessful because the PVC liner kept breaking. A video log of the well was made. The park has the video. A new 9 gpm pump was installed. The well will be used as a backup to Well No. 3.

Elk Creek Well No. 4

A test well was constructed north of Hwy. 50 in Fall 2011. Well No. 4 is 2,500 feet north of Well No. 2 at the campground and 1,000 feet east of the reservoir at East Elk Creek Bay. The well is 263 feet deep. It was constructed by drilling a 14-inch hole to 68 feet (the top of the white sandstone formation) and cementing 10-inch steel casing to that depth. A 9⁷/₈-inch borehole was then drilled through the sandstone and a few feet into the underlying schist. The bottom of the white sandstone unit was at 260 feet. The well was completed by installing a 6-inch PVC liner from 17-263 feet. The bottom 60 feet of the PVC liner is slotted well screen. Pea gravel (3/8") was installed as a filter pack from 190-263 feet. A step drawdown test was conducted at 20, 40, and 50 gpm. Drawdown during pumping at each step was about 35, 60, and 75 feet below the static water level of 130 feet below ground surface. A graph of drawdown and recovery is

provided in Figure 2. Nearly 20,000 gallons of water were pumped during the 8-hour duration of the pumping tests, an average of 40 gpm.

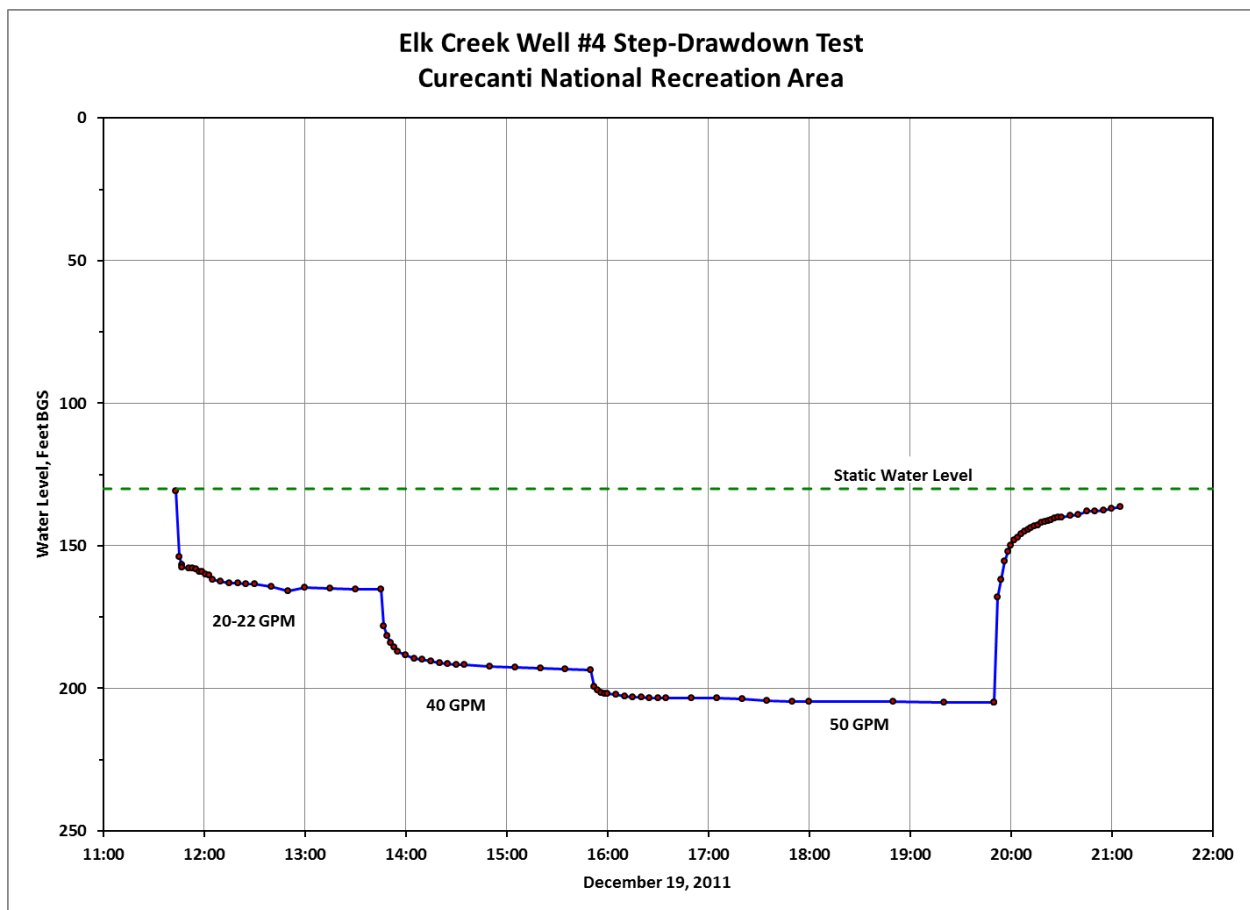


Figure 2. Graph of water level in Well No. 4 during a step drawdown test.

Future plans are to extend electrical service to Well No. 4 and construct a water line to incorporate the well into the water system for the East Elk area.

Hydrogeology

Figure 3 shows part of the geologic map for the Elk Creek area (Hedlund and Olson, 1973) draped over a 3-D projection from GoogleEarth. Figure 4 shows a north-south geologic cross section through the area.

The Junction Creek Sandstone (labeled Jj) is shown in green on the map and cross-section. The full pool level of the reservoir is shown as a black line on the geologic map. The Junction Creek Sandstone has been eroded away in the vicinity of the campground (note that it is missing on the geologic cross-section). The sandstone is present south of the campground, but it is above the water level in the reservoir in this area and thus it is dry.

On the geologic cross-section, we can see that any well drilled at the campground would encounter only bedrock of the Black Canyon Schist Formation. Groundwater in the schist occurs only within fractures in the bedrock.

The sandstone comprising the Junction Creek Formation was 120 feet thick at Well No. 3 and 200 feet thick at Well No. 4. The Junction Creek Sandstone is shown as a thin green unit on the geologic cross-section. It dips toward the north at about 3-9 degrees. It is overlain by the relatively impermeable Morrison Formation (labeled Jm).

If there was an interest in constructing a deeper well to supply the group campground at East Elk Creek, the Junction Creek Sandstone would be a good target aquifer. It should be encountered at about 250-500 feet below ground surface at the campground. A better estimate of the expected depth could be made after a geologic investigation of the area, including measuring elevations of land surface at existing wells to determine the elevation of the top of the sandstone, rather than our current knowledge of only the depth below ground surface.

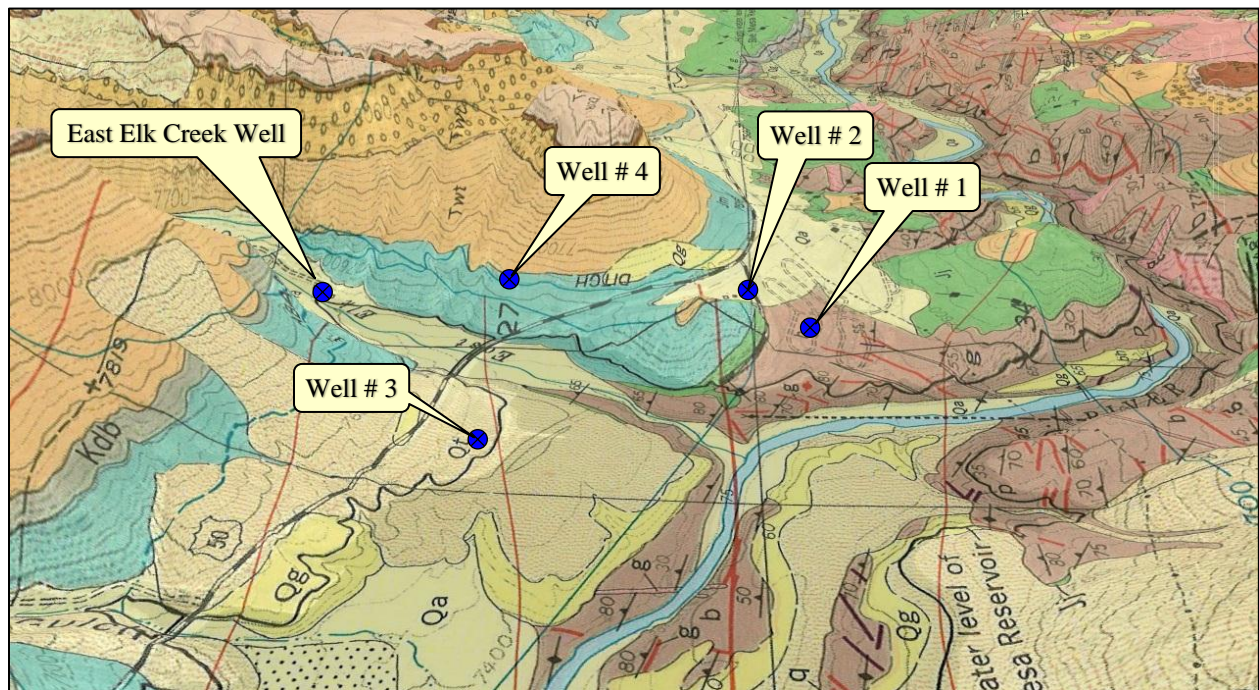


Figure 3. Geologic map overlain on 3-D Google Earth projection.
View is toward the East.

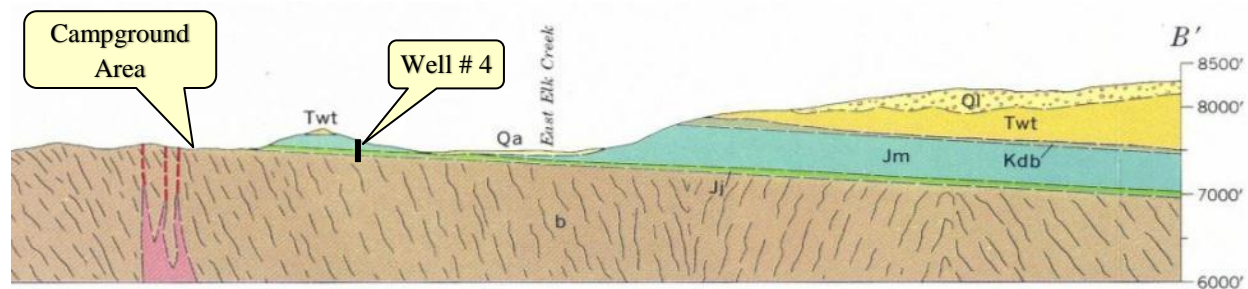


Figure 4. South to North geologic cross section through the Elk Creek area.
View of this cross-section is looking west.
(from Hedlund and Olson, 1973; Geologic Map of the Carpenter Ridge quad)

References

- Hedlund, D.C., and Olson, J.C., 1973, Geologic Map of the Carpenter Ridge quadrangle, Gunnison County, Colorado, U.S. Geological Survey Geologic Quadrangle Map GQ-1070, Scale 1:24,000
- Westwater Associates, 1991, Alternative Water Supply Well Location, Elk Creek Facilities, Curecanti National Recreation Area, unpublished